REPORT ON THE THIRD IMPERIAL MYCOLOGICAL CONFERENCE 1934

Price 2s. net

THE IMPERIAL MYCOLOGICAL INSTITUTE
KEW, SURREY
1934

REFERENCE ONLY

COMMONWEALTH MYCOLOGICAL INSTITUTE
20 JAN 1960

IMPERIAL MYCOLOGICAL INSTITUTE

EXECUTIVE COUNCIL

Sir Charles J. Howell Thomas, K.C.B., K.C.M.G., *Chairman*, United Kingdom

Nevill L. Wright, F.I.C., *Vice-Chairman*, New Zealand

Colonel George P. Vanier, D.S.O., M.C., Canada

F. L. McDougall, C.M.G., Australia

G. W. Klerck, South Africa

J. M. Adams, F.R.C.Sc., Irish Free State

Sir Bhupendra Nath Mitra, K.C.S.I., K.C.I.E., C.B.E., India

B. F. Wright, Southern Rhodesia

R. V. Vernon, C.B., Colonies, Protectorates, and Mandated Territories

Secretary: Sir David Chadwick, C.S.I., C.I.E.

STAFF

Director and Editor

E. J. Butler, C.M.G., C.I.E., D.Sc., F.R.S.

Assistant Director

S. P. Wiltshire, M.A., D.Sc.

Mycologist

S. F. Ashby, B.Sc.

Assistant Mycologist

E. W. Mason, M.A, M.Sc.

PRINTED IN GREAT BRITAIN

REPORT ON THE THIRD IMPERIAL MYCOLOGICAL CONFERENCE 1934

THE IMPERIAL MYCOLOGICAL INSTITUTE
KEW, SURREY
1934

CONTENTS

	Page
Report on the Third Imperial Mycological Conference	3
Resolutions	8
Appendix I. The Director's review of the work of the Institute	11
Appendix II. Minutes of the scientific discussions of the Conference	16
Appendix III. Report of the Sub-Committee on the finance and organization of the Imperial Mycological Institute	29
Appendix IV. Report of the Sub-Committee appointed to consider plant-protective legislation and health certificates	31

REPORT ON THE THIRD IMPERIAL MYCOLOGICAL CONFERENCE, 1934.

1. Calling of the Conference.

The second Imperial Mycological Conference, held in September, 1929, reaffirmed a resolution passed at the first Mycological Conference in 1924 to the effect that, in view of the value to overseas mycologists of such meetings, further conferences should be arranged at quinquennial periods. The Managing Committee of the Imperial Mycological Institute felt some doubt whether, having regard to the prevailing economic depression, it would be opportune to hold such a Conference in 1934, but they came to the unanimous conclusion that the general advantages of such a Conference would much outweigh any considerations which might make its postponement desirable. They accordingly recommended that the Conference should be convened, and in view of the then proposed transfer of the Institute to the Executive Council of the Imperial Agricultural Bureaux, the approval of this Council for the proposal was sought and obtained. The Secretary of State for the Colonies accepted this recommendation, and invitations were conveyed to overseas Governments of the British Empire and to certain Government Departments of the United Kingdom for a Conference to be held in London in September, 1934.

2. Delegates.

The following delegates were designated to attend the Conference:—

A.—Home and Dominion Governments, &c.

United Kingdom—Mr. J. C. F. Fryer.
Dr. G. H. Pethybridge.
Dr. M. Wilson.
Mr. A. E. Muskett.

Canada—Dr. H. T. Güssow.
Australia—Mr. G. Samuel.
New Zealand—Mr. J. C. Neill.
South Africa—Mr. J. E. Van der Plank.
Irish Free State—Dr. P. A. Murphy.
India—Dr. W. McRae.
Dr. H. Chaudhuri.
Southern Rhodesia—Mr. B. F. Wright.

B.—Colonial Governments, &c.

Colonial Empire—Mr. F. A. Stockdale.
British Guiana—Mr. E. B. Martyn.
British Honduras—Mr. H. P. Smart.
Ceylon—Mr. C. N. E. J. De Mel.
Cyprus—Dr. R. M. Nattrass.

East African Agricultural Research Station, Amani—Mr. T. W. Kirkpatrick.
Federated Malay States—Mr. A. Thompson.
Gambia—Mr. J. Pirie.
Gold Coast—Mr. J. Wright.
Kenya—Mr. C. A. Thorold.
Jamaica—Mr. F. E. V. Smith.
Mauritius—Mr. G. E. Bodkin.
Nigeria—Mr. J. West.
Northern Rhodesia—Mr. C. J. Lewin.
Palestine—Mr. E. Ballard.
Sierra Leone—Mr. F. C. Deighton.
Tanganyika—Mr. J. C. Eyre.
Uganda—Mr. A. S. Thomas.

Mr. R. E. Massey attended in the capacity of an expert loaned by the Government of the Sudan.

Mr. G. Howard Jones, Dr. T. Fahmy, and Mr. Y. A. Salam El Alayli attended as Observers representing the Egyptian Government.

Prof. H. R. Briton-Jones represented the Imperial College of Tropical Agriculture, Trinidad, and Mr. A. Sharples the Rubber Research Institute of Malaya.

Visitors.

Invitations to attend the Conference and take part in the discussions were issued to the staffs of Agricultural and Horticultural Research Stations, University Departments, and individual mycologists in the United Kingdom and to the representatives of certain firms interested in the manufacture of fungicides. The majority of those invited were fortunately able to attend, and their presence and assistance in the discussions were much appreciated.

3. Place of Meetings.

By the courtesy of the Governing Body of the Imperial College of Science and Technology, all meetings of the Conference were held in the Metallurgical Lecture Theatre of the College, Prince Consort Road, South Kensington. In addition the Governing Body arranged for delegates and visitors attending the Conference to partake of meals at the College Union.

4. Programme.

The following programme was arranged for the Conference:—

Monday, 17th September.

10 a.m.—Opening of the Conference by Sir Charles Howell Thomas, K.C.B., K.C.M.G., Chairman of the Executive Council of the Imperial Agricultural Bureaux.

10.30 a.m.—The Work and Organization of the Imperial Mycological Institute.
11 a.m. to 1 p.m.—Administrative Measures (including Legislation) against Plant Diseases.
2.30 p.m. to 4.30 p.m.—Methods of Standardization of Insecticides and Fungicides.

Tuesday, 18th September.

10 a.m. to 1 p.m.—Virus Diseases of Plants: with special reference to the control of those which are transmitted by Insects, e.g. of Tomato, Tobacco, and Cotton.
2.30 p.m. to 4.30 p.m.—Simplification of Control Measures for use by Small Cultivators.

Wednesday, 19th September.

Excursion to East Malling Research Station.

Thursday, 20th September.

10 a.m. to 1 p.m.—Foot-rots of Cereals.
2.30 p.m. to 4.30 p.m.—Papers and discussions on:—
(i) Control of Turf Diseases.
(ii) Drought Effects on Potatoes.
(iii) Co-ordination of Mycological Work in the Empire.

Friday, 21st September.

10 a.m. to 1 p.m.—Breeding and Selection for Immunity against Disease (e.g. in Potato, Cotton, Tropical Crops).
2.30 p.m. to 4.30 p.m.—Papers and discussions on:
(i) Root-rots of Rubber.
(ii) Brown Heart of Swede Turnips.
(iii) Gumming Disease of Sugar-cane.

Saturday, 22nd September.

10 a.m. to 11.15 a.m.—Citrus Diseases.
11.15 a.m. to 12.30 p.m.—Cotton Diseases.
12.30 p.m. to 1 p.m.—Closing session.
3 p.m. to 5 p.m.—Visit by Conference delegates to the Imperial Mycological Institute, Kew.

5. Government Dinner to Delegates and Members of the Executive Council of the Imperial Agricultural Bureaux.

His Majesty's Government in the United Kingdom gave a dinner at Claridge's Hotel on the evening of the 17th September to delegates and members of the Executive Council of the Imperial Agricultural Bureaux. The Right Honourable Earl De la Warr (Parliamentary Secretary to the Ministry of Agriculture and Fisheries) presided, and proposed the toast of "The Third Imperial Mycological Conference", to which Dr. H. T. Güssow responded.

6. Opening of the Conference.

The Conference was opened by Sir Charles Howell Thomas, K.C.B., K.C.M.G., Chairman of the Executive Council of the Imperial Agricultural Bureaux, at 10 a.m. on the 17th September. After welcoming the delegates and visitors, Sir Howell Thomas commented on the increasing number of Governments represented at each succeeding Conference, and remarked that such increased representation was a recognition of the importance of the work of mycologists throughout the Empire and of the benefits to be derived from the discussions, co-operation, and contacts which the Conference made possible. After paying a special tribute to the valuable work of Earl Buxton as Chairman of the Managing Committees of the Imperial Institutes of Mycology and Entomology, he stated it was a matter of common knowledge to research workers that under Lord Buxton's direction and the wise guidance of their Committees the two Institutes had proved so useful that at the Imperial Agricultural Research Conference in 1927, delegates from all parts of the Empire recommended to their Governments that Bureaux in eight other branches of agricultural science should be established.

The supervision of these eight new Imperial Agricultural Bureaux was entrusted by the Governments of the Empire to a Council composed of nominees of the several Governments, which elected its own Chairman and controlled its own finances.

As a result of the Imperial Conference at Ottawa in 1932, a Committee under the Chairmanship of Dr. O. P. Skelton, the Canadian Under-Secretary of State for External Affairs, was appointed by the Governments of the Empire to examine the organization and work of various inter-Imperial bodies. That Committee examined *inter alia* the work and organization of the Imperial Institutes of Entomology and Mycology, and, whilst approving the work being done by these two Institutes, considered that their general control and administration should be brought more into line with the constitutional relationship between the various countries as represented by the Imperial Agricultural Bureaux. They therefore recommended that in future the general financial and administrative supervision of these two Institutes should be entrusted to the Executive Council of the Imperial Agricultural Bureaux. These recommendations were accepted by the Governments concerned, and thus it was that he, as Chairman of that Council, had the privilege of opening the Conference and, speaking for himself and his colleagues in that Council, of publicly recognizing the excellent work which had been done by Lord Buxton and the Managing Committees in bringing these two Institutes to such a stage of usefulness that the representatives of all portions of the Empire accepted them generally as models for the establishment of eight other Bureaux and that the Skelton Committee recommended their continuance.

The ten years before the last Conference were notable for the very

rapid development of interest in the Colonial Empire, as in the United Kingdom, the Dominions, and India, in the causes and control of plant disease. During the five years since the last Conference that development had on the whole been maintained, notwithstanding the financial stringency which had prevailed. One of the most striking changes in plant pathology of the last few years was the increasing attention to virus diseases. Towards the investigation of these diseases the Empire Marketing Board had given welcome aid, and research was being actively pursued not only in England and the Irish Free State but also in parts of the Empire as far distant as Australia and South and East Africa.

In the United Kingdom and Dominions no new and dangerous outbreak of a major disease had been noted during the last five years, but there was a growing recognition of the toll taken by existing diseases, especially those affecting roots and cereal crops. In the Colonial Empire witches' broom of cacao in Trinidad, rubber mildew in Malaya, and leaf curl of cotton in the Sudan had caused much anxiety. The idea behind these Institutes and the Bureaux was co-operative service for the common good of Empire agriculture, but however assiduous and keen the Director and staff of the Institute might be, co-operative effort could not flourish without the active and constant interest of the co-operators. Therefore, it was the wish of Dr. Butler and of the Council that the delegates should treat the Institute as their own institute and use it in the future even more than in the past in the interest of agriculture throughout the Empire. The review of its work and the technical discussions would no doubt suggest further useful services, and he assured the Conference that, within the limits of the objectives of the Institute and of practical finance, such suggestions would always receive the most careful consideration. After commenting on the procedure of appointing committees to consider the work and finances of the Institute and other matters, the Chairman repeated his hearty welcome on behalf of the Council of the Imperial Agricultural Bureaux and wished the Conference every success.

7. Finances and organization of the Institute.

Following the opening address by Sir Howell Thomas, the Director reviewed the work of the Institute during the preceding five years and outlined the present position. He explained the action which had been taken to give effect to the various resolutions passed by the last Conference, but stated that action on certain resolutions had been obliged to be postponed as the necessary funds had not been forthcoming. The Director's review is published as Appendix I to this report.

A sub-committee was then appointed to consider the finance and organization of the Institute, with special reference to the present position and the requirements for the next five years.

The Sub-Committee was composed as follows:—

Sir DAVID CHADWICK (Chairman), Mr. NEVILLE WRIGHT, Dr. H. T. GÜSSOW, Mr. SAMUEL, Mr. NEILL, Mr. VAN DER PLANK, Dr. MURPHY, Dr. MCRAE, Mr. STOCKDALE, and Dr. BUTLER (Director).

The report of this sub-committee is printed as Appendix III to this Report. The sub-committee concluded that the minimum expenditure to maintain the Institute satisfactorily during the next five years would amount to an average of £7,700 per annum, which sum would include the provision of an additional assistant as recommended by the Conference held in 1929. The sub-committee's report was unanimously adopted by the Conference at its closing session.

During the Conference a sub-committee was also appointed to consider plant-disease legislation with special reference to the form of health certificate for plant imports and exports, and the report of this sub-committee, which, with minor alterations, was unanimously adopted by the Conference, is printed as Appendix IV to this Report.

8. General Discussions of the Conference.

A summary of the papers and discussions of the Conference is given as Appendix II to this Report.

9. Visit to East Malling Research Station

A visit to East Malling Research Station, Kent, on the 19th September, was arranged for official delegates and other Government representatives and those representing research stations overseas. The work in progress at this Station and the advances made since the last visit of the Conference greatly impressed the delegates, and the hospitality extended by the Director of the Station was warmly appreciated.

10. Resolutions.

The following resolutions were adopted by the Conference:—

1. This Conference desires to place on record the considerable satisfaction with which it has noted the progress that has been made during the past five years in regard to legislative measures relating to the control of the distribution of plant diseases. Group arrangements have already been agreed to in various parts of the Empire, and there is general acceptance of the proposal that a system of health certificates to accompany plant exchanges and imports should be adopted. It is recognized that the acceptance of these health certificates does not imply that importing countries waive their rights to prohibit, inspect, treat, quarantine and destroy, when necessary, plant imports, whether certified or not, nor that the addition of such other requirements as may be deemed necessary in respect of specified plant imports is precluded. The Conference urges that considerable advantage

would be secured by the adoption of a uniform health certificate throughout the Empire, and after considering the action already taken recommends that this general health certificate should take the following form:—

CERTIFICATE.

This is to certify that {the living plants or plant products / a representative sample of the living plants or plant products}

(*Strike out the words not applicable*)

included in the consignment, of which particulars are given below were/was thoroughly examined on the (*date*)..... by (*name*).....

a duly authorized official of the.....

and found to be healthy, no evidence of the presence of any injurious insect, pest, or disease [destructive to vegetation]

[destructive to agricultural or horticultural crops] having been

(*Insert words in [ ] if required by existing legislation*)

found in/on them and that the consignment (including the packing) covered by this certificate has/has not been treated in the following manner (e.g. fumigated with..... or disinfected with.....) {prior / immediately subsequent} to inspection.

{Inspected / Not inspected} in the field by a duly authorized inspector, on.....

.....

(*Signature*).....

(*Official Status*).....

Date.....

No. and description of packages.....

Distinguishing marks.....

Description of living plants or plant products or parts thereof.....

.....

Stated to be grown at.....

Exported by .....

Name and Address of consignee.....

Name of vessel or particulars of route.....

.....

Date of shipment .....

Port or Place of entry.....

Additional Certificate(s) attached .....

(*Give here details of any special certificate or certificates issued in respect of imports specifically scheduled by the importing country*).

2. The Conference further considers that measures should be taken to enable Empire countries to maintain up-to-date information regarding changes in the legislation relating to plant protection and in the regulations issued thereunder. The Imperial Mycological Institute is rendering valuable service in this direction, but it is recommended that the Executive Council of the Imperial Agricultural Bureaux be asked to invite the several

Empire Governments to have prepared for circulation within the Empire memoranda showing in digest form the legislative position in regard to plant imports as at 31st December, 1934, and to make arrangements for the regular circulation from that date of changes of regulations relating thereto as and when they occur.

3. The Conference also desires to draw the attention of all Empire countries to the possibility of the introduction of plant diseases by air transport, and recommends that there should be adopted a general prohibition against the transport of living plants by air passengers, and that special consideration be given to the inspection of plants imported by means of air carriage.

4. This Conference, in view of the large number of insecticides and fungicides offered to growers throughout the Empire and the absence of exact knowledge regarding their efficacy for the purposes for which they are sold, considers that steps should be taken to ascertain whether greater standardization cannot be effected. Fundamental research into standardization of insecticides and fungicides from the point of view of biological efficiency is of the greatest importance in order that methods may be worked out which, combined with the existing standardization in regard to chemical and physical properties, may provide the information necessary for the regulation of their sale and use.

The Conference, therefore, recommends that this requirement of agriculturists and horticulturists throughout the Empire be brought to the attention of the Executive Council of the Imperial Agricultural Bureaux, with the request that it direct the attention of the several Councils for Scientific and Industrial Research or similar organizations in the United Kingdom, the Dominions, and India to the need for fundamental research by mycologists and entomologists into methods for the biological standardization of fungicides and insecticides.

It also recommends that the Executive Council inquires into the possibility of co-ordinating this work both within the Empire and with that being carried out on similar lines in other countries.

5. This Conference unanimously adopts the report of the Sub-Committee appointed to examine the finance and organization of the Institute.

11. Votes of Thanks.

At its final meeting the Conference passed a cordial vote of thanks to the authorities of the Imperial College of Science and Technology and of the Imperial College Union for the use of rooms for meetings of the Conference and for the facility granted to delegates and visitors of taking meals at the College Refectory. The Conference also expressed its thanks to Dr. Butler and his staff for the unsparing efforts they had made to render the Conference a success.

APPENDIX I

The Director's review of the work of the Institute.

During the past five years the Imperial Mycological Institute has undergone a period of great and increasing anxiety in order to maintain its services as unimpaired as possible in the face of falling revenues. This has resulted in the depletion of a considerable part of its reserve fund, and it will be necessary for the Conference to review the position carefully in the light of the statements which have been prepared to show the present financial position and the working deficit revealed by the accounts of revenue and expenditure. These accounts will be examined in Committee, but there are one or two matters of more general interest which may be referred to here.

The services which the Institute attempts to supply cannot be provided cheaply. Cut below a certain point of efficiency they cease to have any real value. For instance, the *Review of Applied Mycology*, which is the mainstay of the Institute's information service, is a heavily subsidized journal. It is read by a very small body, for there are not a great many workers in this field of science. The American journal *Phytopathology* has probably the largest circulation of any devoted solely to the subject, but it had at the beginning of this year only 502 subscribers outside the ranks of the American Phytopathological Society. The *Review of Applied Mycology* has just 50 more subscribers than this, outside the ranks of the Empire countries which contribute to its production and receive free copies in exchange. It is probable that these two journals are the two most widely read in the subject, yet they cannot expect an effective circulation of more than 1,000 or 1,200, a very small number compared with other branches of science. Foreign countries do not help to bear the loss on the production of the *Review*, though its utility is freely acknowledged by them, and it is, therefore, for the mycologists of the Empire to say whether it is worth the money spent on it. There is clear evidence that the subscription price cannot be raised any more. The total circulation reached its peak, 1,038, in December 1932, and has declined since to 979, a loss of 59, mainly no doubt due to the depression, but in some part, perhaps, the result of recently raising the subscription from 18*s*. to 21*s*. Similar considerations apply to the other services of the Institute. They are expensive relatively to the number of workers, but in view of their consultative nature they have to be kept at as high a standard as possible. If not they would simply not be used.

Though their numbers are small the problems that phytopathologists have to face are great, far greater perhaps than they themselves sometimes recognize. One hears so much about the destruction of crops caused by insect pests that it was rather surprising to find Morstatt estimating in 1928 that the German crops lost annually from cryptogamic diseases 10·8 per cent. as against 7·8 per cent. from insects—and Morstatt is an entomologist, not a mycologist. Both together he estimated cost Germany £80,000,000 a year. Of this sum the losses in the potato crop accounted for over £18,000,000, a staggering figure. But Salaman last year estimated that the virus diseases alone of potatoes in Great Britain excluding the Irish Free State caused a wastage of about £4,000,000 a year at present and considerably more ten years ago, before they were understood.

In Australia the losses from crop diseases excluding insects were estimated at £7,000,000 a year in 1920; in the little country of Switzerland at from £2,800,000 to £3,600,000; in Holland at £2,500,000, both these last from estimates made in 1927. Professor Murphy has calculated by various converging methods that Ireland lost potatoes worth a round £200,000,000 from blight between the first outbreak of the disease and 1926, a period of 80 years. New Zealand reckoned in 1927 that it lost annually 50 per cent. of its potato crop from diseases other than the virus group.

Cereal losses are equally appalling. Biffen and Engledow wrote in 1926 that cereal rusts were costing the world £100,000,000 a year. And now one is beginning to recognize that perhaps the cereal foot-rots are as serious. In Australia and Canada there is more than a suspicion that this group of cereal diseases is doing more damage than the rusts at the present time. Yet a few years ago few of those who have worked in cereal countries suspected this. Who can blame the farmer when he attributes his

poor crop to a bad season and not to the fungi that are perhaps destroying its roots, new instances of which, in countries like Canada and Australia, are still being identified in disconcerting numbers ?

To turn to tropical and sub-tropical crops, more spectacular instances of the ruin of large agricultural industries from disease are familiar to most, from the time of the destruction of the Ceylon coffee industry by leaf disease between 1869 and 1883, to the more recent experiences with Panama disease and bunchy top of bananas, sugarcane mosaic, withertip of limes, bud rot of palms, and a dozen others. But here again one wonders whether the mass attacks of weak or obscure parasites do not cause in the aggregate as much damage as the few major diseases one hears so much about. There will be at least a strong suggestion in a paper which Mr. Massey will present to the Conference that something of the kind occurs in the great cotton tract in the Gezira, where the two obvious major diseases, blackarm and leaf curl, may in some years be actually overshadowed by the root-rotting wilt due to less strongly parasitic fungi, the existence of which has only just been realized.

In view of the imperfect state of knowledge of this kind of pathological factor it is not surprising that it is sometimes more difficult to persuade Governments to make adequate provision for the study of plant diseases than for that of insect pests. Any one can see what insects do to the crops—a locust invasion can scarcely be missed by even the least observant person—but it takes a very heavy shower of rust spores to be seen, and very often it is hard to persuade either the grower or the agricultural authority, let alone Government, that invisible cryptogamic parasites are devastating the crops. Plant pathologists themselves do not always fully realize what is happening until accurate statistical surveys are made—the strawberry root diseases are a case in point at the present moment.

The reason why it is worth stressing this aspect of plant pathology now is that during the past five years there have been several occasions when it has been clear that it is not fully appreciated. It is necessary to emphasize the fact that the plant pathologist has to concern himself with every aspect of the health of the plant. Its susceptibility to the attacks of parasites is, no doubt, his chief preoccupation, but unless he is ready to go behind this and seek for underlying causes, he is in danger of losing his place as an essential member of the agricultural research organization. Something of the kind has already taken place in not unimportant parts of the Empire where crop experimentation, crop improvement, and the work of the plant breeder are being carried out without the aid of the specialized knowledge and experience of the plant pathologist, though that is more needed now than ever before. Economy on this side of agricultural science, of the kind that is now so seriously hampering the work of the Institute, is bad policy in the long run.

Turning now to the action taken on the Resolutions of the last Conference: Resolutions 1 and 15 were referred to the Organizing Committee of the Fifth International Botanical Congress at Cambridge in 1930. That Committee decided that no useful purpose would be served by discussing the proposal to reprint important mycological books now out of print (Resolution 15), but that it should be announced from the Chair that the Mycology Section would receive resolutions regarding an abstracting journal for systematic mycology (Resolution 1). This was done but met with no response. Resolutions 3, 5, 8, 9, 10, 11, and 12 were conveyed to the Overseas Governments concerned. Resolution 4 was communicated through the Foreign Office to the Governments of France, Spain, and Portugal with an invitation that they should co-operate with the British West African Colonies in measures to exclude witches' broom disease of cacao from West Africa. In most, if not in all, cases the necessary legislation has since been introduced. Resolutions 7 and 7*a* will be referred to when the present Conference considers the question of health certificates for plants. Resolution 13 was communicated to the Agricultural Meteorological Committee of the Ministry of Agriculture and fully discussed by a sub-committee of that body, whose report has led to a considerable extension of activity in England in the study of the relations between weather and disease in plants. Resolution 2 has had the effect of stimulating the production of handbooks dealing with the diseases of certain major crops, but the Institute found itself unable to take any active part in this, owing to

the crisis through which it has been passing. The same applies to Resolution 6, which called on the Institute for work in regard to the mapping of the geographical distribution of important plant diseases, work which with its diminished resources it has been quite unable to undertake. The results of the action taken on the financial Resolution (No. 16) will be more appropriately referred to the Committee which will deal with the finances of the Institute.

The two big events in the history of the Institute in the past five years have been the building of its new quarters and its transfer to the new Managing Body referred to in the Chairman's speech. Those who have not yet seen the new building will be able to do so during the Conference. There is no need to say more than that it has proved as satisfactory to work in as it is pleasant to look at, and that a great deal is owing to the Empire Marketing Board for helping to provide this excellent building.

Progress in the publication of regional fungus floras has not, for financial reasons, been as rapid as was hoped for, but has still been not inconsiderable. The largest is that for India which Dr. Bisby helped the Director to bring out in 1932. Others based mainly on determinations made in the Institute have been published from Tanganyika, British Guiana, Trinidad, and Southern Rhodesia. Large collections from several colonies, especially those of tropical Africa, are continually under study at the Institute, chiefly by Mr. Mason, with a view to providing material for further lists. But Manitoba is the only part of the British Empire overseas which may claim to have an adequate account of its fungi in the list prepared by Bisby, Buller, and Dearness in 1929.

A Third Annotated Account of Fungi received at the Imperial Mycological Institute was issued by my colleague E. W. Mason in 1933. It reflects to some extent a side of the work which has grown into prominence during the past five years, namely, the identification and study of mould fungi other than those which are parasitic on growing crops. Mould injury to stored produce, moulds in milk, butter, and cheese, in cacao, in cured tobacco, in the soil, in cotton and woollen fabrics, are all being studied now not only at home but in the Dominions and some of the Colonies. A considerable proportion of the fungi involved have found their way to the Institute for naming, and this has been a heavy call on the time of Mr. Mason and the other members of the staff, for these organisms are not well known anywhere. Another notable feature of Mason's Annotated List is the new conception there advanced of the taxonomic value of certain types of conidia in the Ascomycetes and Imperfecti.

Dr. Wiltshire has undertaken a fundamental study of one of the most difficult groups of the Dematiae, those having spores of the general type of *Alternaria*, *Macrosporium*, and their allies. These include parasites and saprophytes and are sent for naming very frequently; the confusion amongst the recorded species is so great that nothing less than a detailed study of the whole alliance is required, and this Dr. Wiltshire, with great courage, has undertaken. Several papers already published mark the early stages of the work.

Mr. Ashby continues to be the recipient of species of *Phytophthora* requiring determination from all over the world, as he is the recognized authority on the genus, one of the most destructive alike in tropical and in temperate climates. During the period under review several important advances in knowledge of the host range and distribution of these parasites are due to him, the chief being perhaps the determination that both *Phytophthora cambivora* and *P. cinnamomi* can cause ink disease of chestnuts; the establishment of the presence of both these fungi in the recently discovered outbreak of ink disease in chestnuts and beeches in England, of *cinnamomi* attacking walnut in Australia, and of *cambivora* on avocado pear in South Africa; the extension of the range of *P. hibernalis* on citrus from the Western Mediterranean and Australia to South Africa and California; the determination of *P. megasperma* for the first time outside the United States on carrots in Tasmania and potatoes in Northern Ireland; the identification of the several species responsible for citrus gummosis in Cyprus, Palestine, Egypt, India, and other areas; the discovery of what is apparently *P. citricola*, hitherto only known from Formosa, as a cause of citrus fruit rot in South Africa, and of *P. parasitica nicotianae* on tobacco in Nyasaland and Mauritius; and the identification of several interesting species from Scotland.

Another large side of Mr. Ashby's work, in which the rest of the staff collaborated for particular items, was the determination of an extraordinarily large range of fruit-rotting fungi from many parts of the tropics and sub-tropics. Of these the largest number came from West Indian bananas, tomatoes, &c.; from Palestine, Cyprus, Rhodesian, and South African citrus; and from Indian mangoes. With the fungi obtained from the roots and ears of cereals, the latter including a good many species of *Fusarium* the identification of which is most difficult, these form the largest groups that have been sent in. Other important and time-absorbing groups include the stigmatomycoses or internal boll-rotting fungi, on which Mr. Ashby is the leading authority and which are now found to cause injury to many seeds, pulses, and fruits; a large assortment of Phycomycetous fungi from South Africa; and a considerable number of tree parasites and timber-decaying fungi from Canada, Australia, South Africa, and elsewhere. In several of these cases the aid of outside specialists has been required, and thanks are due for the help which the Institute has received from specialists like Miss Wakefield, Mr. Petch, Dr. Wollenweber, Professor Chupp, Dr. Wehmeyer, and a number of others in many countries. But it has been rather the policy of the Institute to take up, itself, on critical lines, the study of certain commonly occurring groups of which accurate determination is difficult. Besides those already mentioned, much time has been given to bacterial diseases, e.g. of sugar-cane, to certain parasitic *Sclerotia* prevalent in the tropics, and to various other smaller groups of the kind.

Members will be aware that a special fund was established some years ago to provide for overseas tours by the staff of the Institute. This has had, regrettably, to be abandoned owing to the economies that became necessary a few years ago, and only two such tours were undertaken in the period under review, one by Mr. Ashby in 1930 to advise on sugar-cane diseases in Mauritius and the other by the Director in 1931 to see the conditions in regard to diseases of the Gezira cotton crop in the Sudan. Both these tours were of great value to the Institute in helping it to deal with inquiries from these areas with knowledge of the local conditions and were, no doubt, of use also to the local plant pathologists and Departments. It is hoped that a time will come when this important side of the Institute's functions can be revived, for the results were well worth the cost.

In regard to the very important subject of plant quarantines and plant disease legislation, the Institute has throughout the period been consulted by the Colonial Office and by several local administrations, not only on broad questions but on technical details such as the design of quarantine houses, the preparation of "black lists", and the like. The subject is to be more fully discussed during the Conference, and it need only be said that it is one in regard to which the Institute has sometimes to face grave responsibilities in giving advice, and which is felt to be one of the most difficult with which it has to deal. But by degrees the machinery is improving and certain general principles are emerging, such as those covered by the local quarantine stations, group agreements, and other matters to be discussed more fully another time. Almost any policy that one adopts at present is open to criticism from some quarter, but the general trend is towards agreement on the major points.

Another matter which may be referred to briefly is the rather unexpected indications of success in the biological control of certain scale insects prevalent and extremely destructive in the Seychelles. Based on the absence of certain fungal parasites of these insects from large collections received, steps were taken first to grow *Pseudomicrocera henningsii* in culture from scales from the West Coast of Africa and later to obtain a virulent strain of *Cephalosporium lecanii* from Mysore. Large cultures of these were sent to the Seychelles, where they have gone ahead remarkably well. In some of the subsequent sendings of infected material from the Seychelles to us over 90 per cent. of the scales had been killed by the fungi, which it is hoped are now well established and like the humid island climate of that Colony. Subsequently various other fungi likely to attack the white grub (*Phytalus*), which is doing so much damage to sugar-cane in Mauritius, were sent to that island, with results that are not yet known.

The new building has helped greatly in maintaining direct contact with overseas

mycologists and plant pathologists who come to England. All three of the laboratories set aside for their use have been in occupation for considerable periods at a time, and it is seldom that one at least is not in use. The periods of occupation have varied from about a year to a week or ten days. Another way in which contacts are fostered is by arranging for the publication in England of scientific papers by overseas colleagues, and in the past five years about 20 of these have been seen through the Press.

These are some of the activities of the Institute, especially such as have not been referred to in previous quinquennial reviews. They do not take into account the ordinary daily routine of preparing abstracts for the *Review*, which claims to miss no serious paper in any language, and reading the proofs, of answering inquiries on all kinds of subjects and of identifying miscellaneous packages of fungi or single specimens from almost all parts of the world. This work is done by a staff of four scientific officers, three abstractors and translators, and an office staff of three. This was felt five years ago to be rapidly becoming insufficient for the work. It is now definitely insufficient, and the cases in which inquiries cannot be adequately dealt with are now numerous. The Institute can only try to do the best it can with wholly inadequate resources.

APPENDIX II

Imperial Mycological Conference, September, 1934

Meeting: *Monday, 17th September,* 11 *a.m.*

Chair: Mr. F. A. Stockdale

Discussion: **"Administrative measures (including legislation) against plant diseases."**

Mr. Stockdale (Colonial Empire) in opening the discussion reviewed the progress which had been made during the last five years in the realm of legislation against plant diseases. He drew attention to the form of certificate of inspection recommended by the last Conference and stated that various governments of the Empire had proposed modifications which it would be necessary for the Conference to consider. A big advance in legislation was achieved by the initiation of group agreements between contiguous countries. The first of these was among the South African group, comprising South Africa, Northern and Southern Rhodesia, and the Belgian Congo; a second was being arranged for the East African Colonies, including Kenya, Uganda, Tanganyika, and Zanzibar; a third for the West African Colonies, and a fourth for the West Indies. Quarantine stations had been established at the Imperial College of Tropical Agriculture, Trinidad, and at Amani, in addition to those already erected at Mauritius and Durban; a quarantine house had also been built at Kew. Finally he called attention to the danger of air services in the introduction of diseased material.

Dr. Güssow (Canada) appreciated the progress that had been made and thought that the certificate could best be reconsidered by a committee. An advance that had been made in Canada was the revision of the Destructive Insect and Pest Act to give the authorities power to prohibit the export of diseased material. He referred to the group agreements in force in the continent of North America.

Mr. Fryer (United Kingdom) stated that it was important that each country should know precisely the meaning to be conveyed by the terms of the certificate. Quarantines had their limitations, and he considered it essential that they must be backed by a very efficient intelligence service within the country.

Dr. Pethybridge (United Kingdom) said that the Ministry of Agriculture had abolished the schedule of plant diseases, as non-scheduled diseases were apt to be overlooked. There was no legal authority in Great Britain to prevent the export of diseased material, but such material would not be certified.

Dr. Güssow explained the necessity of preventing the export of maggot-infected apples to Great Britain and cited other instances. He considered the time would come when such prohibitions would become general.

Dr. Butler (Imperial Mycological Institute) mentioned an instance when hop cuttings sent to Australia from England, where downy mildew is prevalent, were intercepted and destroyed on arrival, the Australian authorities having been duly warned by him. He considered it was not fair to Australia to allow such hops to be sent.

Dr. Wilson (United Kingdom) drew attention to forest tree diseases which had been introduced into Great Britain with nursery stock, but stated that the importation of such stock was now prohibited. He stressed the importance of an efficient intelligence service.

Mr. F. E. V. Smith (Jamaica) supported Dr. Güssow's view. With regard to air services he stated that in Jamaica plant material was not infrequently found in passengers' personal luggage. Plant certificates were valuable according to the authority issuing the certificate; the signature of the certifying officer was of great significance.

Dr. Güssow stated that in Canada every air passenger is required to make a declaration that he is not carrying any plant material in his baggage.

Prof. Briton-Jones (Imperial College of Tropical Agriculture, Trinidad) described the Quarantine House at Trinidad and the procedure adopted in importing planting material.

Mr. Bodkin (Mauritius) gave an account of the Quarantine House at Mauritius.

Mr. Kirkpatrick (East African Agricultural Research Station, Amani) spoke of the Quarantine House recently erected at Amani, the regulations regarding which were read to the meeting.

Mr. Sampson (Royal Botanic Gardens, Kew) described the Quarantine House at Kew.

Mr. F. E. V. Smith called attention to the danger of virus diseases slipping through quarantine unobserved.

Mr. Stockdale proposed that a sub-committee be appointed to consider the form of certificate, and this was done.

Meeting: *Monday, 17th September*, 2.30 *p.m.*

Chair: Mr. Nevill L. Wright

Discussion: **"Methods of standardization of insecticides and fungicides."**

Dr. Güssow (Canada) in introducing the subject gave an outline of the procedure adopted in Canada, the United States, and Germany. In Canada an Act for the regulation of the sale of fungicides was passed in 1927, the primary object of which was to prevent the sale of fraudulent products. All products have to be registered; the well-known and tested substances are granted registration immediately; those tested to a limited extent but known to be effective are allowed registration temporarily; for those untested experimental data are requested and tests arranged, whilst the worthless materials are refused. Applications for registration require to be accompanied with a fee of $20, and the name and percentage of all ingredients have to be stated. Every registration expires on 31st December. In the United States similar control is established. In Germany the procedure involves duplicated tests the data from which are referred to an official body, which rejects or permits the use of the material. The ingredients are either disclosed or communicated confidentially. The testing of fungicides by field tests gives the most satisfactory results, but it requires money and time, and it is very desirable that research should be undertaken in connexion with the laboratory testing of such materials.

Dr. Martin (Long Ashton Research Station) discussed the application of physical and chemical tests for the standardization of fungicides. The data so obtained should give a good idea of the biological performance by the material, and assuming this can be so gauged the specifications might be worked out on the basis of the "pharmacopoeia" method or of the "active constituent" method. Tentative methods may have to be used until the data requisite for satisfactory specifications are available. Registration of proprietary fungicides under an official body was required, and it was suggested that manufacturers should register their products, state the composition confidentially, and declare any subsequent change of composition, and should not use registration for the purposes of advertisement.

Mr. Neill (New Zealand) spoke of the futility of working with materials of unknown composition which may vary at the pleasure of the manufacturer, and moved that "this Conference agrees in future to undertake no tests with proprietary fungicides unless the composition thereof is disclosed to the pathologist in charge of the tests".

Mr. Muskett (United Kingdom) supported Mr. Neill's resolution, but suggested the addition of the words "and unless no change be made in its composition without duly notifying the pathologist".

Mr. Sharples (Rubber Research Institute, Malaya) described the scheme for the regulation of the sale of fungicides in operation in Malaya. Substances for the treatment of mouldy rot of rubber are tested at a fee of $250, and satisfactory materials

are placed on a white list. There was no difficulty in getting proprietors to carry out the terms of the scheme, and it was not necessary for manufacturers to declare the method of manufacture. He opposed the resolution.

Dr. Callan (Imperial Chemical Industries) welcomed any movement to enforce the declaration of the active constituent to an authority, not to individual plant pathologists, but with regard to accessory substances, introduced for stabilizing or other purposes, he considered that these should not be disclosed; they give little information to the plant pathologist but much to competitors. He was in favour of standardization but thought that practice is very far behind what is required for chemical control.

Mr. Wakely (Bayer Products) stated that he was quite prepared to disclose active ingredients of products to the head of the institute carrying out tests. It was their practice when the composition of a product was altered to make an addition to the name to indicate such a change. He endorsed the German scheme of testing fungicides and would be pleased to co-operate with pathologists in carrying out tests.

Mr. Cartwright (Forest Products Research Laboratory) described the procedure being adopted in testing timber preservatives at the Forest Products Research Laboratory. The composition is divulged confidentially, and the report allowed to be printed in full or only approved extracts of it. Standardization tests are now being studied. A suggestion for standardization had already been before the British Standards Institute.

Dr. Pethybridge (United Kingdom) doubted the necessity of Mr. Neill's resolution; he questioned whether manufacturers have any right to demand that the pathologist should test their substances. The British Standards Institute Committee had decided to report that the time was not ripe for standardization.

Mr. Massey (Sudan) mentioned the work now carried out annually in the Sudan of disinfecting 15,000 tons of cotton seed. He had found that firms are ready to disclose the composition of their products. He welcomed the prospect of standardization.

Prof. Murphy (Irish Free State) remarked on the great improvement that had taken place in the proprietary articles and considered it was desirable to co-operate with the manufacturer and bring the products under control as much as possible.

Dr. Butler suggested that the time had not come to pass any strong resolution such as Mr. Neill proposed.

Mr. Neill withdrew his resolution, and it was agreed that a resolution should be drafted emphasizing the importance of work on testing fungicides and submitted to the Conference at the concluding session.

Meeting: *Tuesday, 18th September, 10 a.m.*

Chair: Dr. G. H. Pethybridge

Discussion: **"Virus diseases of plants: with special reference to the control of those which are transmitted by insects, e.g., of tomato, tobacco, and cotton."**

Dr. E. S. Moore (South Africa) introduced the subject with an account of virus diseases of tobacco and tomato in South Africa. These place increasingly burdensome limitations upon the commercial culture of these crops, and the present situation regarding their practical control calls for serious consideration from both pathologist and entomologist. Leaf curl of tobacco, recorded in 1927, reached epidemic proportions in 1932–3, while in 1934 it practically disappeared. Kromnek of tobacco and of tomato (spotted wilt group) cause serious losses: the symptoms of these diseases were described in detail. Bunchy-top of tomato is characterized by a bunching of the foliage and brings about a marked reduction in the yield of the crop. Tobacco mosaic produces a mottling of all new growth, but there may be no check on growth and the damage is not so spectacular. The transmission of these diseases by insects was discussed: in the case of bunchy-top the insect vector is unknown

though one probably exists. The serious nature of these diseases is such that if control is not effected the outlook for the growers concerned is very dark. The wide scope of the research required for the study of these diseases was briefly indicated.

Mrs. M. A. Watson (Rothamsted) contributed a paper on "Some factors influencing the probability of infection by aphids with the virus Hy III". Regular weekly infections of tobacco and *Hyoscyamus* seedlings with Hy III transmitted by *Myzus persicae* showed that with fewer aphids a correspondingly reduced percentage infection was obtained. Seasonal variations in percentage infection was correlated with (*a*) the amount of virus present in the host plant at the time of feeding, and (*b*) the weather conditions immediately preceding the aphid feeding. The control of aphid infestations by spraying should be attempted, preferably when there is not so much virus available to the aphis, and this corresponds to periods of bright sunshine.

Mr. Bald (Australia) gave an account of his work on the incidence of tomato-spotted wilt in field-plots at the Waite Agricultural Research Institute during the years 1926–33. Variations in temperature from day to day were reflected in the infection records; a temperature maximum twelve days earlier showed a good correlation with the number of plants diseased. The temperature variations seemed to affect both the insect vectors and the plants' response to the disease. Methods were developed of testing whether diseased plants were scattered at random in the field, and were used to investigate sources of infection and the likelihood of transmission from adjacent infected plants.

Dr. K. M. Smith (Cambridge) made some suggestions for the control of tomato-spotted wilt in England. The two main aspects of virus disease control are the production of resistant varieties of the host and the development of measures against the insect vector. Biological control of the latter may be attempted by breeding Hymenopterous parasites of the thrips, by the use of predaceous insects, and by the propagation of an entomogenous fungus, whilst the insecticidal control may be attempted by nicotine and other sprays, and by steaming of the soil. The host range of the virus is wide and tomatoes should be grown in a house by themselves, infected plants being promptly rogued out.

Dr. Caldwell (Rothamsted) discussed the virus diseases of the tomato in England and Canada. Many of the virus complexes occurring in England are also found in Canadian material and similar diseases are caused by the same virus or viruses in both countries. Different reactions may follow the inoculation of a second virus into tomato plants previously infected with another virus. Some viruses confer on plants immunity against a second virus, while in other mixtures the two groups of symptoms may appear normally or the mixture cause a more severe disease than either component. Tobacco virus No. 6 he considered a mixture of two strains AG and AY. No case of seedling infection with virus diseases had been seen out of many thousand of tomato plants grown; and for control purposes the grower should start with clean material and endeavour to keep it clean.

Prof. Murphy (Irish Free State) stated that in Ireland they were concerned with spotted wilt, tobacco virus No. 1, and streak disease caused by two viruses one of which was potato mosaic of the *x* type. He recommended the use of tomato plants for tests of potatoes for freedom from virus diseases; the potato virus worker always specified the variety of potato involved, whereas this was not so with workers on other crops. The danger of virus-infected material slipping through quarantines he thought to be very great.

Mr. Massey (Sudan) gave an account of the control of leaf curl of cotton in the Sudan, where it was first seen in 1923–4 and became a serious menace four years later. The virus is apparently endemic in the Sudan, for it occurs on Malvaceous weeds far from cotton and is common on *Hibiscus esculentus*. The disease was perpetuated by the practice of chopping off the cotton plants at ground level after cropping, as these sprouted. The control of white-flies, the insect vector, was impracticable on such a large scale, but removal of the roots, thereby preventing ratoon growth, has proved very successful. In addition highly resistant strains of cotton resembling Sakel have been found and one of these, 1530, is now being grown on a large scale. Hybridization is also giving promising results.

Dr. K. M. Smith referred to the strains AG and AY mentioned by Dr. Caldwell and asked for his opinion whether they were distinct strains or mutations.

Dr. Caldwell said he considered them strains of the same virus, as X bodies are associated with both.

Mr. Samuel called attention to the fact that spotted wilt, which appeared in Australia in 1915, occurred in South Africa many years earlier. He thought the difficulties of controlling this disease in glasshouses to be very great, as the thrips was difficult to detect, and with the incubation period of 13 days roguing must always lag behind. Bald's method of statistical analysis of field results will probably prove valuable, and it might be applied to other diseases.

Dr. Butler commented on the note of despair that was sounded regarding the control of virus diseases, and pleaded for the co-operation of the entomologists in the control of the very important insect vectors.

Meeting: *Tuesday, 18th September,* 2.30 *p.m.*

Chair: Dr. H. T. Güssow

Discussion: **"Simplification of control measures for use by small cultivators."**

Mr. Jones (Egypt), in opening the discussion, stressed the importance to Governments of the application of control measures against plant diseases and the necessity for the mycologist not to be satisfied merely with laboratory results. The difficulty of controlling disease in Europe was great, but in tropical countries with native populations the problem was infinitely greater. Government measures such as quarantine, eradication campaigns, and supply of resistant varieties are nearly as easy in peasant countries as among large farmers. In Egypt during 1933–4 the extra returns actually obtained from the introduction of a new cotton variety amounted to £300,000 and valuable results had been obtained with wilt-resistant cowpea varieties and in the control of cereal diseases. Control measures suitable for the small farmer must be reasonably efficient, exceptionally cheap and exceedingly simple, and require materials and apparatus readily available. As long as one of these essential requirements was not met, a method was useless. Examples of simplified control measures were the use of sulphur against barley smut, the soda and soap spray against vine powdery mildew, and the use of bouisol against rose mildew. Propaganda, especially by means of posters, was recommended.

Mr. De Mel (Ceylon) gave a brief outline of the present machinery in Ceylon for the control of plant diseases. Difficulties in the control of disease in village holdings centred in those which cannot be brought under Government regulations. The simple preventive methods such as "cut and burn" do not appeal to the cultivator who wants "remedies" and "cures". Spraying is not practicable because (1) the villager is unsuited to the handling of poison sprays, (2) simple sprays are not available for the chief diseases, and (3) the value of the produce does not generally bear the expense. The better class of cultivator is very willing to learn to carry out control measures, and selected individuals of this type should be used as examples in the villages in which they dwell. Education of the younger generation is the most hopeful avenue to success for the future, but posters and lectures should be utilized for introducing ideas for plant sanitation and other methods of disease control.

Mr. Neill (New Zealand) described the methods adopted in the elimination of seed-borne diseases of malting-barley crops in New Zealand. By centralized hot-water treatment of the seed supplied to the farmers for the growing of malting barley it had been possible to obtain a very large measure of control of both covered and loose smuts and stripe. The modified Jensen method of treatment adopted was described in detail. One-bushel lots of barley were placed in 3-bushel sacks, presoaked in water at 65° to 70° F. for not less than 5 hours or more than 5 hours 20 minutes, transferred to a steeping tank at 127° F. for 5 minutes, then plunged into cold water at 55° F. for 5 minutes, and finally placed in the kiln for drying. With 10 men it was possible

to treat 100 bushels at a time. The seed so treated was grown on the seed farm and the grain harvested distributed to growers. The result had been the complete control of smuts and stripe in the seed-treated crops and a tremendous rise in the yield and quality of the grain, the effect of which was to reduce the cost of production by 15 per cent.

Dr. McRae (India) stated that in India the problem of control of plant diseases in native holdings was similar to that in Egypt, except that in India more expensive treatments can be given to such valuable crops as betel vine, areca nut, and coffee. In the Punjab recently a method has been elaborated for the hot-water control of loose smut of wheat, which causes a loss round about £400,000 per annum in that Province. A vessel half filled with water is exposed to the sun from 8 a.m. till noon, when the seed is added and steeped till 4 p.m., after which it is spread out to dry. The temperature of the water rises to between 110° and 122° F., and the treatment, which is within the compass of any cultivator, has given good results.

Prof. Briton-Jones (Imperial College of Tropical Agriculture) considered that the breeding of immune varieties was one of the most efficacious methods of controlling disease in native farms. The treatment of seed at a central seed-testing station might be feasible, but sprays should be avoided as much as possible. He doubted the value of posters.

Mr. Jones questioned whether the breeding of varieties resistant to all diseases was practicable.

Dr. L. Balls (Egypt) cordially agreed that the plant-breeder can only go so far; it was impossible to breed for everything.

Dr. Güssow (Canada) said it was well worth while even to control one disease by breeding and instanced the breeding of rust-resistant wheats in Canada.

Mr. Bodkin (Mauritius) was of opinion that campaigns were of very little use and that concerted Government action was much more likely to produce good results.

Mr. Eyre (Tanganyika) stated that control of coffee diseases in native-owned holdings in Tanganyika had been effected by Government action. Stringent regulations enforced by a large number of inspectors have resulted in the plots being maintained in a sanitary condition. Spraying is done largely by a co-operative society and neglected plots are liable to be uprooted if not cleaned up. The result had been the very satisfactory output of 1,200 tons of coffee from the native holdings last year.

Meeting: *Thursday, 20th September,* 10.0 *a.m.*

Chair: Professor P. A. Murphy

Discussion: **"Foot-rots of cereals."**

Mr. Samuel (Australia) discussed the incidence of foot-rots in Australia, where the losses caused by these diseases are surprisingly large, exceeding those from rust. The wheat belt of Australia can be roughly divided into three climatically different zones in which *Ophiobolus graminis*, *Fusarium culmorum*, and *Helminthosporium sativum* are, respectively, the main root-rotting pathogens. Most of the wheat lands had been opened up from eucalyptus scrub, and in South Australia *O. graminis* became a menace within a few years. Weed hosts of the fungus are common, but by sowing rye-grass with the wheat the weeds are choked out. Biologic antagonism to the pathogen is probably an important factor in the disease, which is favoured by late rains.

Mr. Garrett (Australia) spoke of the effect of soil conditions upon the infection of wheat seedlings by *O. graminis*. On the light mallee soils wheat is much more susceptible than on heavy clay soils. In the former the fungus grows freely down the root, in the latter it makes poor growth and sometimes appears to be suppressed altogether. A method, based on the growth of the hyphae down the root, was devised for evaluating the effect of different soil conditions on the fungus concerned. Biologic

antagonism of other soil organisms was established but conflicting results were obtained in temperature experiments with the fungus.

Dr. Güssow (Canada) reviewed the work on the foot-rots carried out in recent years in Canada. Surveys indicated that the losses caused by these diseases approach those caused by stem rust. Various types of root-rot are recognizable, namely, (1) prematurity root-rots, which are unimportant and the cause of which is not known, (2) brown root-rots, which are most troublesome on wheat and are caused by *Pythium arrhenomanes* var. *canadensis*, *P. volutum*, &c., chiefly occurring in Saskatchewan, (3) take-all (*O. graminis*), and (4) common root-rots due to *H. sativum*, *F. culmorum*, and other fungi. The latter two types have been studied most. Take-all occurs in fields newly brought into cultivation; it can live in soil two years and is more prevalent in wet than in dry years. *O. graminis* comprises a number of strains, while all grasses are not equally susceptible, and maize is practically immune. Control measures should include the eradication of volunteer wheat and grasses, and crop rotation, shallow seeding, and packing of the soil. Common root-rot investigations have included a taxonomic study of the species of *Fusarium* involved, cytological studies, and experiments on the effect of amputation of roots, the antagonism of associated organisms, and on the control of the disease.

Dr. Bennett (Armstrong College) stated that the *Fusarium* disease of cereals is responsible for greater loss in England than any other cereal disease. *O. graminis* also occurs, either alone or with *Fusarium* spp. *H. avenae* attacks oats, while *H. sativum*, *Pleospora herbarum*, *Phoma*, *Ramularia*, and others are generally intermixed. Thirty species of *Fusarium* have been isolated, the most prevalent pathogenic species being *F. culmorum* and *F. avenaceum*, but associated with defective plants are common, non-pathogenic species. The importance of identifying the species of *Fusarium* involved in any foot-rot was emphasized and the taxonomic characters useful in this work pointed out.

Miss Glynne (Rothamsted) discussed the incidence of take-all on differently manured plots of the continuous wheat and barley experiments on light soil at Woburn Experimental Station. The effect of manures was very noticeable. At Ph values of 5 or less there was no disease, but where the value was high, frequently there was a distinct loss.

Dr. O'Brien (West of Scotland Agricultural College) stated that *H. avenae* was responsible for a pre-emergence blight of oats in Scotland causing a loss of 70 to 80 per cent. Studies on various aspects of the disease had been made. Soil temperature during germination had proved to be the dominant factor in infection; the earlier the sowing the heavier the loss. Soil infection is negligible in practice; the major source of infection is in the seed coat and control by treatment with ceresan and agrosan have given very good results. Perithecia resembling those of *H. teres* were found on oat stubble in a field sown down to grass.

Mr. Muskett (United Kingdom) stated that in Northern Ireland the primary phase of *H. avenae* on oats is the most deleterious, the secondary phase being harmful in causing grain infection. As with oat smuts, the incidence of the disease is dependent on the season as well as the degree of infection of the seed grain. Both smuts and leaf spot were controlled satisfactorily by the use of organic mercurial seed disinfectants.

Meeting: *Thursday*, 20*th September*, 2.15 *p.m.*

Chair: Mr. B. F. Wright

Discussion: **"Foot-rots of cereals"** (*continued*).

Mr. Thorold (Kenya) gave an account of the incidence of cereal foot-rots in Kenya, where take-all (*O. graminis*) was first recorded in 1931. The disease is most prevalent at the higher altitudes, influenced perhaps by the low temperatures but also no doubt by the continuous cultivation of wheat which obtains on such land. When wheat follows oats, the crop is usually good. At lower altitudes *Fusarium* spp.

and *F. moniliforme* (*Gibberella moniliformis*) occur on wheat, and the latter and *G. saubinetii* on maize.

Mr. Neill (New Zealand) asked if there was any connexion between the cob-rot and foot-rot of maize.

Mr. Thorold stated that infected seed gives infected seedlings.

Mr. Padwick (Canada) considered that take-all may be increasing in Canada, but the matter remains in doubt, as from some thousands of plants with such symptoms *O. graminis* could not be isolated. The method of inoculation in tests of the effects of other organisms on the growth of *O. graminis* was criticized.

Mr. Samuel drew attention to the fact that take-all was present in Australia in 1851, whilst it had only been recorded in Canada in 1910.

Dr. Wilson (United Kingdom) said that *O. graminis* was comparatively rare in Scotland as the soil was acid and heavy for the most part. *Fusarium* spp. were more serious in the south-east. *Acremoniella* and *Typhula* (*?*) *graminum* were also present. The depth of seeding is of some importance in relation to foot-rots; shallow seeding may be of some use against *H. avenae*.

Paper: **"The control of diseases of turf of golf and bowling-greens."**

Dr. Bennett (Armstrong College) stated that the commonest diseases of turf in Britain are "patch" and "rust" caused by *Fusarium nivale* and *Corticium fuciforme*, respectively. The American diseases due to *Rhizoctonia* had not been observed. Other casual invaders were species of *Mortierella*, *Sclerotium*, *F. culmorum*, *F. herbarum* and its var. *avenaceum*. Malachite green used with dilute Bordeaux mixture had proved extremely satisfactory as a means of control, being much more toxic than mercuric chloride, non-poisonous, and beneficial to the grasses at the strength used. In response to inquiries the speaker explained that the toxicity of the malachite green was tested in cultures grown on media containing known proportions of the fungicide, and that Bordeaux mixture was used to prevent the soluble malachite green from being washed away.

Dr. O'Brien said he had found *R. solani* on greens in Scotland and that he had obtained excellent control with organic mercury compounds.

Paper: **"Some observations on the effects of drought on potato tubers."**

Prof. Murphy (Irish Free State) reported that during the drought of 1933 the yields of plots of potatoes, dug at intervals, fell instead of rising uniformly. The partial explanation of this was provided by the fact that certain tubers in adjacent plots were obviously shrivelled at digging time, principally at the heel end. These tubers sprouted in October without any rest period. Rapid uptake of water and the restoration of turgidity followed only on the development, in moist soil, of sprouts and more particularly of root formation. The condition resembled the American "jelly end rot", which may be due to a similar cause. These results were considered to have a bearing on the geographical distribution of potato varieties.

Mr. F. E. V. Smith (Jamaica) said he had observed the same disorder in Jamaica. After drought followed by rains potatoes may produce secondary tubers or new shoots. Seed potatoes which are shrivelled when planted may still be turgid when the crop is harvested. The daylight period may have some significance in connexion with the problem.

Dr. Millard (Leeds) suggested that non-sprouting of Scotch seed may be a reverse effect due to the presence of excessive moisture.

Paper: **"Co-ordination of mycological work in the Empire."**

Dr. Hopkins (Southern Rhodesia) introduced the subject with a paper read by Mr. B. F. Wright. Commenting on the many demands of the overseas mycologist, he deplored the lack of opportunity afforded him for research on plant diseases and suggested that post-graduate students in the universities should be encouraged to take up practical problems instead of purely academic studies. Tests of parasitism, determination of viruses, histological studies, refinements of technique were lines of work which would be very helpful to overseas mycologists, whilst assistance could be

afforded to the universities by the supply of herbarium specimens, sketches, and photographs. He thought that centres might be established where suggestions and inquiries could be received.

Prof. Briton-Jones (Imperial College of Tropical Agriculture) was doubtful whether the scheme was feasible, but he would welcome exchange of specimens with Dr. Hopkins.

Dr. Butler and Mr. Ashby (Imperial Mycological Institute) considered tests of parasitism of tropical fungi would be unreliable if carried out under artificial conditions in England.

Dr. Wilson (United Kingdom) agreed, but thought that anatomical studies could be made and that exchange of specimens would be useful.

Dr. McRae (India) emphasized the necessity for importunity in making requests for specimens.

Dr. Butler questioned whether virus specimens could not be tested at home, but drew attention to the danger of spreading disease.

Dr. Pethybridge (United Kingdom) spoke of the pressure of work on the home mycologists.

Meeting: *Friday*, 21*st September*, 10.0 *a.m.*

Chair: Professor V. H. Blackman

Discussion: **"Breeding and selection for immunity against disease (e.g., in potato, cotton, tropical crops)."**

Mr. Hansford (Uganda) communicated a paper, read by Mr. A. S. Thomas, on the breeding of native crops for resistance to disease. The author considered that difficulties of devising suitable measures for the control of native crop diseases are so great that the development of resistant varieties offers the best means of attaining this end. The first thing to do is to sort out the varieties from the mixed populations comprising the native crops, to select the most promising, and to improve these by further selection. Cotton breeding in Uganda against black arm (*Bacterium malvacearum*) is being attempted by selection from present varieties, by selection from resistant but otherwise undesirable U. 4 derivatives and by crossing U. 4 with the best cottons in cultivation locally. The system of co-operation between the plant breeder, the entomologist, and the mycologist adopted in this work has proved satisfactory and is being extended to ground-nuts and *Eleusine coracana*.

Dr. Fahmy (Egypt) reviewed the work which had been done in Egypt on breeding for immunity from cotton wilt (*Fusarium vasinfectum* var. *aegyptiacum*). Cotton plants can be classed as (*a*) susceptible, (*b*) resistant, when the diagnostic leaf-mottling of the seedling is followed by the recovery of the plant, and (*c*) immune, the last-named breeding true or segregating into immune, resistant, and susceptible individuals. From cotton seedlings raised in pots in infected soil in greenhouses at 28° to 30° C. from seed of healthy plants in diseased patches in the field, the immune plants are transplanted into the field and selfed seeds obtained. Their progenies are grown under the same conditions for successive generations until totally immune families are obtained, selection for quality being carried out at the same time. In immune by susceptible crosses genotypic immune families are obtained in the F_3, while in many commercial varieties and in botanically pure strains of complex genetic composition as to wilt resistance the susceptible element can be eliminated by the sifting-out process. Several immune strains of cotton have been selected, and the method has also been applied to tomato against wilt, and to cowpea against rust.

Miss Glynne (Rothamsted), dealing with wart disease of potatoes, reviewed the methods and results obtained by other workers in breeding wart-immune varieties. Laboratory tests have shown that some varieties, long regarded as immune, show incipient infections which are sloughed off, and the plants recover. Sporangia developed in these incipient infections have been shown to be capable of carrying over the disease, and there was a danger of transporting infection on immune varieties grown in infected soil. The solution of the wart-disease problem seems to lie in the production of a few superlatively good immune varieties.

Miss O'Connor (Cambridge) gave an account of the work of breeding potatoes resistant to late blight (*Phytophthora infestans*) carried on under the direction of Dr. R. N. Salaman at Cambridge. The method adopted to test seedlings for blight resistance is to grow them in a moist frame and to spray them every two or three days with a spore suspension. No immunity from blight is shown by domestic varieties though some are slightly resistant. *Solanum demissum* and aya papa have been used as immune parents. The F_1 generation of a resistant × susceptible cross is usually wholly susceptible. The F_2 of selected seedlings can be tested at the rate of thousands a year, and resistant ones are grown in an insect-proof glasshouse to keep them free from virus infection. Their resistance to blight is further tested by inoculating detached leaves and tubers. A large proportion of the seedlings are very susceptible to virus and other diseases, and it is therefore essential to select for virus resistance and wart resistance as well. Many blight-resistant seedlings with good domestic qualities have already been raised. In 1932 a new biotype of the potato-blight fungus was encountered which infected hitherto resistant seedlings but died out in the following year.

Dr. Cockerham (Scotland) discussed the breeding of virus-resistant varieties of potatoes. No varieties immune from virus diseases are known, but there are some resistant ones. Regarding leaf roll, varieties vary from those showing high resistance to plants yielding small or no crop, whilst towards the *x* and *y* viruses varieties may react as simple carriers or show symptoms of simple mosaic, crinkle, or semi- or fully-lethal necrosis. The A virus is usually carried with few or no symptoms. The varieties highly resistant to leaf roll and carriers of *x* and *y* viruses are useful to the grower. There is no uniform resistance to virus diseases—a variety resistant to leaf roll may be susceptible to mosaic. Resistance to leaf roll is probably mendelian but many factors may be involved.

Prof. Cheesman (Imperial College of Tropical Agriculture) presented a paper on the breeding of bananas for resistance to Panama disease (*Fusarium* [*oxysporum*] *cubense*), which was read by Prof. Briton-Jones. By crossing Gros Michel with the fertile resistant species *Musa acuminata* resistant hybrids have been obtained, but most of these occasionally set seeds, one seedling alone, I.C. 2, being exceptional in this respect. Several other fertile species are now available for crossing Gros Michel. Cytological investigations showed that the wild species of *Musa* are normal diploids, Gros Michel and most edible bananas are triploids, whilst the hybrids are tetraploids. By crossing tetraploids with diploids it may be possible to regain the triploid condition, while triploids may possibly be synthesized from hybrids from diploid species alone.

Dr. McRae (India) spoke of the work done by Dr. Shaw on breeding wilt-resistant pigeon pea in India. Seed from resistant individuals was grown on, and by selection of the selfed progeny a very resistant type was obtained together with other resistant strains. Hybridization work had also given promising results. Valuable work had also been done in India in breeding against sugar-cane diseases and wheat rusts.

Mr. F. E. V. Smith (Jamaica) stated that Mr. Sutherland's work indicated that resistance to Panama disease in the banana may be dominant, and the results obtained by Dr. Growth tend to show this also.

Dr. Pethybridge (United Kingdom) said he was not satisfied with the evidence for the existence of biotypes of *Phytophthora infestans*, especially as these have died out both in Germany and in this country. With regard to incipient infections with wart on resistant varieties, he questioned whether such varieties ought not to be excluded from the official list of immunes. Incipient infections had been found in the field in Holland. Too much reliance should not be placed on laboratory tests for immunity.

Miss Glynne entirely agreed that laboratory tests for wart immunity should be followed by field tests.

Mr. G. H. Jones (Egypt) stated that considerable success had been obtained in breeding in Egypt, but he did not want this aspect overstressed.

Dr. McRae supported this point of view.

Mr. De Mel (Ceylon) emphasized the need for systematic work on the banana.

Mr. Dickinson (Cambridge) thought that laboratory tests for resistance might be usefully employed in breeding work.

Mr. A. S. Thomas (Uganda) considered that no amount of laboratory work will do away with field tests.

Miss O'Connor mentioned that there were no visible morphological differences between the two forms of *Phytophthora infestans* except that the hyphae in the new type appeared more branched or twisted. The new type thrived in cultures for about year and then towards the end of 1933 refused to grow at all.

Meeting: *Friday*, 21*st September*, 2.30 *p.m.*

Chair: Mr. J. C. Neill

Paper: **"Root-rots of rubber."**

Mr. Sharples (Rubber Research Institute, Malaya) limited his remarks to the two most important root-rots in Malaya, namely, those caused by *Fomes lignosus* and *Ganoderma pseudoferreum*. The former is a disease of young trees, whilst the latter is present from the earliest stages but develops much less quickly. Spread of these fungi by growth through the soil and by spores is of little practical importance, and infection of young trees is entirely dependent on close contact of diseased jungle timber with their roots. Complete removal of infected jungle timber in planting and replanting is therefore important. Trenching is useless until root contact between rubber trees is fully established; it can be usefully employed against *G. pseudoferreum* when the trees become more mature.

Dr. Butler commented on the great importance of the work and on the fact that the disease showed up in plantations but not in the jungle.

Mr. Garrett (Australia) thought that spread through root contact may apply to other root-rotting fungi, e.g., *Ophiobolus graminis*.

Prof. Briton-Jones (Imperial College of Tropical Agriculture) considered that soil acidity and such factors may greatly influence the parasitism of these fungi. Trenching should be associated with drainage.

Mr. Sharples stated that no disease was discernible in plantations when jungle was again allowed to grow up. Trenching had been discarded except for isolating a badly diseased area from healthy ones. As regards parasitism the evidence was based on figures only.

Paper: **"Brown heart of swede turnips."**

Dr. Güssow (Canada) said that brown heart was one of the most important factors in the production of turnips in certain regions of Canada. Affected turnips appear sound externally but are light in weight, and the tissues within form a greyish-brown, punky mass. There was no evidence of a parasitic agent. Heavy dressings of manure have a beneficial effect on the incidence of the disease, but applications of sodium tetraborate resulted in 78 to 97 per cent. control whilst other elements were ineffective. The export of turnips to U.S.A. amounted to 10,000 to 15,000 tons per annum, and this commerce was threatened until the disease was found to be very widely spread in the United States also. He wondered whether it was present in other countries.

Mr. Neill stated that the disease is known in New Zealand under the name of mottle heart. Mr. Waters had found that wood ashes, whether leached or not, were beneficial. Recent studies had suggested that mottle heart was associated with a virus.

Dr. Horne (Imperial College of Science) discussed the symptoms in relation to those of apple-storage diseases.

Mr. Samuel (Australia) drew attention to the parallel of the boron deficiency of beet in Europe.

Mrs. Alcock (Scotland) said that the condition occurred in Scotland.

Dr. Whitehead (Wales) stated that it was found in south Carnarvonshire, and he understood Dr. Pethybridge had observed it in Ireland some years ago.

Dr. Güssow remarked that high light intensity has some effect in enhancing the lack of boron. With regard to the possibility of the trouble being caused by a virus, he emphasized the very definite effect of the boron applications.

Paper: **"Gumming disease of sugar-cane."**

Prof. Ashby (Imperial Mycological Institute) said that this paper was contributed at the request of the Barbados Government, who wished that recent knowledge regarding this disease should be put forward at the Conference. After discussing the symptoms, he referred to the establishment of *Bacterium vascularum* as the causative agent by E. F. Smith, and mentioned that strains of the organism exist and that two varieties of it are probably present in Australia. Crop losses are probably wholly due to systemic infection and may exceed 60 per cent. in Australia. The disease is of long standing in Brazil, Queensland, New South Wales, Fiji, and Mauritius, was recognized more recently in Porto Rico, Lesser Antilles, and Columbia, and is absent from Cuba, Java, and the Hawaiian Islands. The modes of transmission were described, and the influence of ecological factors discussed. Control is effected by means of resistant varieties, and details were given of the method of testing new seedlings for resistance. In relation to quarantine it was stated that the latency of the symptoms is much less pronounced than in leaf scald.

Dr. Fahmy (Egypt) commented on the use of the terms "tolerant" and "resistant", the former of which would be included in his usage of "resistant".

Dr. Güssow remarked on the striking parallel with Stewart's disease of corn. He thought that the paper afforded an excellent example of the value of the Institute to the smaller Governments of the Empire.

Dr. McRae asked for a copy of the paper to be sent to the Agricultural Research Council of India.

Meeting: *Saturday, 22nd September*, 10 *a.m.*

Chair: Mr. Klerck

Discussion: **"Citrus diseases."**

Mr. van der Plank (South Africa) opened the discussion by a general survey of the diseases of citrus trees in South Africa. The campaign for the eradication of citrus canker was briefly reviewed, and it was stated that since 1928 no outbreak had occurred in the Union. Exanthema; scaly bark, in which a virus may possibly be concerned; root-rot, a horticultural problem involving stock incompatibility; and concentric ring blotch, were described in some detail. The last-named disease presents many mysterious features and the etiology is unknown. Scab (*Sporotrichum citri*) is only a problem on rough lemon stock. Sooty blotch (*Gloeodes pomigena*) can be controlled by treatment of the fruit with bleaching powder solution.

Dr. Chaudhuri (India) spoke of wither-tip of citrus caused by *Colletotrichum gloeosporioides* in the Punjab, where it is a major disease and causes great loss by the dropping of fruits, besides withering of the shoot tips, while young plants may be killed. The method of infection, the resistance of different species, and stock influence were discussed. In the nursery the attacks are very serious, and there is a need for mycological control. Spraying experiments against wither-tip and sooty moulds have given satisfactory results.

Prof. Briton-Jones (Imperial College of Tropical Agriculture) described the work on the control of citrus scab in the British West Indies, where it is the main trouble in the raising of sour orange stocks. He found that shading proved an extremely effective method of controlling this disease in nurseries, where it also checks the growth of noxious weeds and reduces the cost of weeding. Gummosis of citrus has become important in Trinidad with the development of the grapefruit industry, on which crop it is the most serious disease, and capable of killing off whole plantations during the first few years of bearing. Trees budded high are much less liable to the disease, against which the sour orange stock is highly resistant. Promising results have been obtained by surrounding the soil at the base of the tree with a slab or protective covering consisting of sand and oil, oil residues, or mortar. Ingrafting above infected areas without removing infected material has been very successful.

Mr. F. E. V. Smith (Jamaica) described the control of citrus wastage, chiefly due to stem-end rot, by packing-house methods in Jamaica. Field methods of controlling

the disease were not practicable. Colouring the fruit with excessive doses of ethylene gas increased infection, but by treating grapefruit and oranges with mild doses and debuttoning afterwards a very considerable degree of control was effected (down to 0·73 per cent. against 12·2 per cent. in the untreated). Borax did not prove efficacious in controlling stem-end or other rots, neither did cold storage give altogether good results. Fruit shipped on deck invariably arrived in better condition than that put in cold storage. Shirlan might be useful as a disinfectant.

Dr. Tompkins (Cambridge) thought that borax might be improved by making it more alkaline. He was not sure that any need be used if diseases were kept down in the packing-house.

Prof. Briton-Jones thought it was impossible to eliminate infection in the packing house; the first step must be to control rots in the field. He inquired whether there was any evidence of wax brushes affecting the incidence of disease.

Mr. F. E. V. Smith stated that the polishing brushes were undoubtedly excellent agents in the spread of *Penicillium* and such-like fungi. With regard to high budding of citrus the practice had entirely controlled gummosis in Jamaica. Exanthema was present in Jamaica on heavy soil and appeared to be connected with excess of nitrogen. Scab had been controlled by shading with bananas.

Mr. Jones (Egypt) mentioned a root-rot of citrus and plums present in Egypt which was connected with the level of the water table.

Discussion: **"Cotton diseases."**

Mr. Massey (Sudan) gave an account of a seasonal deterioration of the cotton crop in the Sudan, associated with root-rot and wilt. It occurred at the end of the rainy season, though frequently following excellent initial growth. An unusually heavy attack in 1933–4 led to the discovery that extensive loss of the fine rootlets was general. Various fungi have been isolated from the roots which show also the presence of a Phycomycetoid endophyte. Laboratory experiments indicated that water-logging of alkaline impervious soil predisposes Sakel cotton to attack by potential parasites normally present in the soil, and drainage and reduction of alkalinity led to healthy development even in the heaviest soils.

Dr. Fahmy (Egypt) discussing the Egyptian cotton wilt observed that the disease appeared in 1902, when the newer susceptible varieties began to be cultivated extensively. The symptoms take longer to appear under field conditions than under optimum conditions for infection. The parasite (*Fusarium vasinfectum* var. *aegyptiacum*) gains entrance through the root cap, invading the vessels, and destroying the root system through repeated infections. The Egyptian fungus differs from the American and Indian strains in cultural characters, parasitism, and slightly in morphology.

Dr. McRae (India) said that work on cotton wilt in India was being reorganized under the auspices of the Agricultural Research Council.

Dr. L. Balls (Egypt) congratulated Mr. Massey on the results of his work, which were of great importance. He wondered whether the mycological phenomena described were causative or symptomatic. He thought that drainage was a most necessary requirement of the Gezira soils, and that in the absence of aeration toxic chemicals might accumulate; possibly the mycological aspect which had been developing was secondary to the soil trouble.

Mr. Thomas (Uganda) stated that in Uganda cotton was grown on acid soils.

Dr. Butler said that he had never seen the slightest indication of the endophytic mycorrhizal fungus becoming parasitic.

Prof. Briton-Jones referred to the penetration of *Fusarium vasinfectum* var. *aegyptiacum* through the root cap and inquired whether there was any anatomical difference between resistant and susceptible varieties.

Dr. Fahmy replied that no difference was evident; in resistant varieties the fungus enters but does not progress, being encircled within the tissues.

APPENDIX III.

Report of the Sub-Committee set up by the Imperial Mycological Conference to examine and report on the finance and organization of the Imperial Mycological Institute.

1. We were directed to examine and report on the finance and organization of the Imperial Mycological Institute, with special reference to the present position and to the needs for the next five years.

2. The position gives ground for anxiety. There was an actual deficit in the year 1933–4 of £334*, and the budget estimates show a possible deficit of £773 for 1934–5. These deficits are being met by drawing on the reserve fund of the Institute, which amounted on 31st March, 1934, to £3,977. It is clear that, if these deficits continue at the rate budgeted for in 1934–5, the reserve fund will be exhausted by, if not before, 1939–40.

3. The five years since the last Imperial Mycological Conference have been years of general financial difficulty. We have examined the action taken by the Institute to meet the situation.

(i) We are informed that none of the special additional work which was recommended at the Conference in 1929, and which would have involved additional expenditure, had been undertaken.

(ii) The additional assistant who, it was anticipated, would be required by 1932–3 has not been appointed.

(iii) When levies on salaries were imposed in the British Civil Service, levies were also made on the salaries of the staff of the Institute, but on account of the present financial position of the Institute, no portions of those levies have as yet been restored, although in the Civil Service half were restored with effect from 1st July, 1934.

(iv) Economies have been effected by postponing purchases of books and apparatus, and also by postponing binding.

(v) The annual subscription to the *Review of Applied Mycology* has been increased from 18*s*. to 21*s*.

4. When the Empire Marketing Board assisted the Institute with its new building, it also gave a grant for apparatus. This has enabled the Institute to carry on with reduced expenditure on apparatus. We understand that the time is due when increased annual provision will have to be made for renewing apparatus. Prolonged economies on library expenditure must impair the work of the Institute and certain binding work is considerably in arrears.

5. We are satisfied that any further economies directed towards bringing annual expenditure within present income can only be effected either by reducing the utility of the *Review* or by a curtailment of some of the work on identification. No delegate was prepared to contemplate a reduction in the present scope of the *Review*. That work and work on identification have always been the essential objectives of the Institute. Each delegate on our Committee emphatically testified to the value of the work on identification and to the need for its continuance. Dr. Butler said that in the last few years the identification work which the Institute had been called upon to do had doubled, and had already passed beyond the capacity of the present staff. We consider this side of the Institute's work to be of fundamental importance to the mycological services in contributing countries, and are unanimously of opinion that the appointment of an additional junior scientific officer should not be further postponed.

6. The number of subscribers to the *Review of Applied Mycology* has decreased by 59, and we cannot advise any further raising of the price.

7. We recognize the prudence on the part of those responsible for the control of the Institute in withholding the partial restoration of levies on the salaries of the staff of the Institute, though we none the less deplore it. We hope that it will become possible to avoid this difference in treatment, for we do not regard it as either satis-

* [Contributions for two years were received from Canada in 1933–4.]

factory or desirable that the staff at this Institute should be treated differently from those at other Institutes.

8. We are of the opinion that the average of the minimum annual expenditure necessary to continue the Institute on a satisfactory basis during the next five years is £7,700 per annum. We arrive at this total as follows:

	£
Net Estimate for 1934–5 after allowing for economy levies on salaries	6,873
Average annual increments in salaries which will fall due in the next five years	89
Additional provision for library, binding, and apparatus, &c.	100
Additional assistant as recommended (average salary)	400
Provision to permit restoration of levies on salaries when and as restored in other services	228
	£7,690

9. Contributions from Governments amounted in 1933–4 to £6,010. The anxiety regarding the financial future of the Institute arises primarily from the fact that, on the outbreak of the depression, certain Governments felt compelled to reduce or even in some cases to stop their contributions to the Institute. As a result the Institute received in 1933–4 £1,265 less than it had reason to expect. In regard to this the Imperial Committee on Economic Consultation and Co-operation wrote in its report (see para. 348) as follows:

> "We hope that those governments that have reduced, or temporarily withdrawn, their contributions to the Imperial Institute of Entomology and the Imperial Mycological Institute will feel able to restore their contributions to the former basis."

We were therefore glad to be informed that the Governments of Fiji and British Honduras have already done so for the current year. We hope that other Governments will be able to do likewise. If contributions are restored to their former levels the revenue we recommend as essential for the Institute will just be attained. We hope, however, if the Conference adopts our report, that the Executive Council of the Imperial Agricultural Bureaux will not only see its way to request those Governments which have felt compelled to reduce their contributions to consider restoring them, but will also either directly or through some of its members explore the possibility of the present contributions from some Governments being increased. The Institute has proved its utility. Its work has grown, is growing and should grow. The estimate we have framed is strictly based on work in sight on the experience of the last two years. It preserves an essential minimum for the work on identification, to which we attach such great importance, but it makes no provision for the extensions envisaged in 1929.

APPENDIX IV.

Report of the Sub-Committee appointed to consider Plant-Protective Legislation and Health Certificates.

We were appointed a Sub-Committee of the Third Imperial Mycological Conference to consider and report upon the progress which had been made since the Conference held in 1929 in developing protective measures against the distribution of plant diseases and particularly to consider the views of Dominion Governments on the proposed form of health certificate for plant imports and exports.

Our Sub-Committee was composed of the following delegates to the Conference: Mr. G. Samuel (Australia), Dr. H. T. Güssow (Canada), Dr. W. McRae (India), Dr. P. A. Murphy (Irish Free State), Mr. J. C. Neill (New Zealand), Mr. J. E. Van der Plank (South Africa), Mr. B. F. Wright (Southern Rhodesia), Mr. J. C. F. Fryer and Dr. G. H. Pethybridge (United Kingdom), Mr. F. A. Stockdale (Colonial Empire), Mr. F. E. V. Smith (Jamaica), and Dr. H. R. Briton-Jones (Imperial College of Tropical Agriculture, Trinidad). Dr. E. J. Butler and Mr. S. F. Ashby of the Imperial Mycological Institute also attended our meetings and gave us the benefit of their advice.

We have held two meetings and have had before us a memorandum summarizing the action which has been taken on Resolution 7 (*a*) of the Second Imperial Mycological Conference held in 1929 and the comments which have been received from Dominion Governments in regard to the proposed model health certificate, as well as a summary of the replies received to the proposal that the question should be again considered at the present Conference.

We have noted with considerable satisfaction the progress which has been made during the past five years in regard to control over the distribution of plant diseases. A group arrangement in regard to the exchange or introduction of plants and plant products has already been reached between Canada and the United States and another between the Union of South Africa, Southern Rhodesia, Northern Rhodesia, and the Belgian Congo. Agreement has been reached for a further group arrangement between Kenya, Uganda, Tanganyika Territory, and Zanzibar in East Africa, and consideration is at the present time being given in Nigeria, Gold Coast, Sierra Leone, and the Gambia to a group agreement in West Africa in regard to plant-protection legislation generally.

There has been general acceptance from all parts of the Empire of the proposal that a system of health certificates should be adopted. The model certificate in the form recommended by the Second Mycological Conference was referred to the Ministry of Agriculture and Fisheries in the United Kingdom and subsequently re-examined by the (then) Managing Committee of the Imperial Mycological Institute. This revised form was submitted for the consideration of His Majesty's Governments in the Dominions, the Governments of India and Southern Rhodesia, and the Governments of the Australian States. A slightly modified form was prepared for adoption in Colonial Dependencies, and this form has been put into operation in all but a few Dependencies such as St. Helena and the Falklands. It has also been adopted by the Government of the Sudan and the Administrations of Basutoland, the Bechuanaland Protectorate, and Swaziland.

It has been recognized that the acceptance of these health certificates does not imply that importing countries waive their rights to prohibit, inspect, treat, quarantine, and destroy, when necessary, plant imports whether certified or not. Similarly, their acceptance does not preclude the addition of such other requirements as may be deemed necessary by individual countries in respect of specified plant imports. We consider that the acceptance of the above provisos is essential and further consider that the provision of health certificates is necessary for the protection of importing countries against the introduction of injurious insect pests and diseases.

We have considered the several replies submitted by Dominion Governments, and would urge that considerable advantage would be secured by the adoption of a uniform general health certificate to accompany living plants or plant products.

We are of the opinion that provision should be made on the certificate for the incorporation of the signature and title of a recognized official of the plant inspection service in the country of origin, and that information should be given as to whether the consignment covered by the certificate has or has not been treated (e.g., fumigated or disinfected) prior to shipment. We are further of the opinion that reference to scheduled pests and diseases of importing countries should be omitted from the body of the general certificate. These schedules change frequently, and where regulations apply to specified plants or plant products it is preferable that these should be dealt with by means of special certificates additional to the general one now under consideration. We are also of the opinion that provision should be included in the certificate for information as to whether the consignment covered by the certificate has or has not come from fields or nurseries which have been subjected to field inspection by the competent agricultural authority of the country issuing the certificate.

We therefore recommend to the Conference the consideration of a Health Certificate in the following form with the hope that if it is approved by the Conference it will prove acceptable to all Governments of the British Empire:

CERTIFICATE.

(This certificate is embodied in Resolution No. 1 of the Conference, see p. 9.)

We have also considered the question of the measures which could be taken to enable Empire countries to maintain up-to-date information regarding changes in the legislation relating to plant protection and in the regulations issued thereunder. We recognize the work which the Imperial Mycological Institute has already done and is doing in this direction, but we consider that as the Imperial Institute of Entomology is also concerned the Executive Council of the Imperial Agricultural Bureaux might be asked to invite the several Governments to have prepared for intra-Empire circulation memoranda showing in digest form the legislative position in regard to plant imports as at a fixed date, say, 31st December, 1934, and that arrangements should be made for the regular circulation subsequent to that fixed date of changes in regulations as and when they occur.

We also recommend that steps should be taken by all Empire countries to prohibit air passengers from importing living plants or plant products and that special consideration should be given to dealing with the importation of plants through air transport.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD
BY JOHN JOHNSON, PRINTER TO THE UNIVERSITY